

Patent Application
Attorney D cket No. LMX-88

UNITED STATES PATENT APPLICATION

OF

ALEXANDER STENZEL

FOR

**VEHICLE MIRROR MOUNTING APPARATUS AND METHOD FOR
ASSEMBLING SAME**

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197

Attorney Docket No. LMX-88

Title of Invention

Vehicle Mirror Mounting Apparatus and Method for Assembling Same

Field of Invention

5 The present invention generally relates to mirror mounting assemblies. More particularly, the invention is directed to mirror mounting assemblies that accommodate an internal wire and allow a mirror housing to be biaxially adjusted relative to a mounting bar without undesired rotation.

Background of Invention

10 Different arrangements are known for mounting external mirrors on vehicles. On large, commercial vehicles, such as trucks and busses, mirrors are often secured within mirror housings mounted so as to extend the mirror away from the vehicle to provide a clear view of different areas around the vehicle. Depending on the size and design of the mirror, as well as the area around the vehicle to be observed, different mounting arrangements have been used. An exemplary mounting arrangement is described in
15 pending U.S. Pat. Application Serial No. 09/390/971, which recites a biaxially adjustable mirror mounting assembly.

20 A drawback in the prior art is that wiring for mirror control motors, heating elements, electronic displays and the like must be routed circuitously about various internal components of existing mirror mounting assemblies. In a tightly spaced mirror mounting assembly, for instance, the wiring may be more susceptible to kinking and premature wear and tear, which may in turn cause the mirror mounting assembly to fail

prematurely. In addition to the above, convoluted internal wiring of known mirror mounting assemblies makes assembly of component parts more difficult.

Another drawback in the prior art is that a space-constrained mirror mounting assembly may require that wiring be installed externally. Thus, the mirror mounting assembly may be unsightly and the wiring may be undesirably exposed to the outside atmosphere. Alternatively, tightly spaced mirror mounting assemblies may require a separate cover for the wiring, thus increasing installation time, assembly weight, and costs.

Brief Summary of Invention

The present invention provides a mirror mounting assembly in which the component parts of the mirror mounting assembly are simple and economical to manufacture, assemble, and use. Other advantages of the invention will be apparent from the following description and the attached drawings, or can be learned through practice of the invention.

In accordance with an aspect of the invention, as broadly described and depicted herein, a mirror mounting apparatus is disclosed for mounting a mirror glass to a mounting rod. The mounting rod is affixable to a vehicle and includes a bore and an outlet. Optionally, a wire to provide power to a mirror control motor, heater element or the like is routed from the vehicle through the bore and exits the outlet into a mirror housing assembly.

The mirror mounting apparatus includes the mirror housing assembly for supporting a mirror glass. The mirror housing assembly has a base member for mounting

to the mounting rod. The base member has a shaft with an opening, which delivers the wire from the outlet of the bore into the mirror housing assembly.

Also included in the mirror mounting apparatus is a compression element, which sits coaxially about the shaft. The compression element resistively urges the mirror housing and the mounting rod together when a locking device, with engaged and disengaged positions, compresses the compression element in the engaged position to releasably hold the mirror housing and the mounting rod together.

In accordance with another aspect of the invention, an alternative mirror mounting apparatus includes an adjusting member with a shaft opening to receive the shaft of the base member and to route the wire into the mirror mounting apparatus. The adjusting member may be adjustably attached to the mirror housing assembly.

The mirror mounting apparatus may include biasing and locking devices. The biasing device, similar to the foregoing compression element, optimally urges the adjusting member, the mirror housing assembly, and the mounting rod together. The locking device has a terminal opening for delivery of the wire into the mirror mounting apparatus, and compresses the biasing device about the shaft. The locking device releasably holds the adjusting member, the mirror housing assembly, and the mounting rod together.

In accordance with another aspect of the invention, a mirror mounting assembly is disclosed having a mirror housing with a mirror for a vehicle. The mirror mounting assembly includes a mounting bar affixable to the vehicle, and the mounting bar has an inner surface that defines a cavity extending axially. The mounting bar also has a first

opening in communication with the cavity, and the cavity can receive a wire from the first opening.

In this example, a base member has a first base surface and a conduit and can be mounted to a portion of the mounting bar. The conduit has a second opening and a
5 securement element and routes the wire to the second opening.

The mirror mounting assembly may also have first and second slide members. The first slide member has a third opening, a first spherical surface, and a receiving surface. The third opening is for receiving the conduit and the wire. The second slide member has a fourth opening and a second spherical surface. The fourth opening is
10 configured to receive the conduit and the wire, and the second spherical surface contacts and seats in the receiving surface. The first and second slide members slideably adjust relative to each other and to the mirror housing.

The mirror mounting assembly may also have a spring compression element and fastener operably similar, respectively, to the biasing and locking devices discussed
15 above. The fastener may be rotatably locked to the securement element to couple the mirror mounting assembly together.

A more detailed aspect of the invention includes the mirror mounting assembly for a vehicle having the mounting bar and the base member, which has a first base surface and a conduit with a second opening. The conduit has a locking key and is
20 configured to route the wire from the outlet through the second opening into the mirror mounting assembly.

This alternative mirror mounting assembly includes a mirror housing with a passage through which the conduit extends, a first receiving surface and a second base surface, which seats against the first base surface of the base member.

Also found in this exemplary embodiment is a first slide member with a third opening through which a conduit extends, a first spherical surface, a second receiving surface, and a first raised arcuate member. The second receiving surface has a second raised arcuate member, which has a first stopping surface, and the first receiving surface contacts the first spherical surface.

A second slide member with a fourth opening, a notch, a second groove with a second stopping surface, a mounting element, a second spherical surface, and a receptacle is also provided. Specifically, the notch is located near the fourth opening, and a spring compression element is provided to compressibly seat in the second slide member. When the mirror mounting assembly is assembled, the first and second stopping surfaces cooperate to impede a movement of the second slide member beyond a predetermined position. The mounting element has a proximal end and a distal end, the proximal end attached to the second slide member, the distal end depending from the proximal end away from the second slide member.

The fastener of this aspect of the invention has a fifth opening, which delivers an end of the wire to the mirror mounting assembly. The fastener can be depressed axially in a direction of the mounting bar to compress the spring compression element and urge together the base member, the mirror housing, the first slide member, and the second slide member. The fastener with a transition surface and the locking key operate to

translate rotation of the fastener relative to the locking key to lock the mirror mounting assembly together.

In another aspect of the invention, a method of assembling a rearview mirror mounting assembly configured for receiving the wire is disclosed. Optimally, the mounting assembly has a housing, a base member with a hole in the base member, a cap member, a spring element, and a fastener. The method of assembling the rearview mirror mounting assembly for a vehicle may include the step of providing a mounting rod with an opening and an outlet. The rod optimally attaches to both the vehicle and to the base member. The opening in the rod should permit the wire to be fed through the rod and into the housing from the outlet.

Additional steps of the exemplary method may include providing the wire, feeding the wire through the opening in the mounting rod, feeding the wire through the hole in the base member and into the housing from the outlet, and connecting the wire to an element in the housing. The element can be an electric motor wire, a heating element wire, a signaling device wire, a hydraulic line, and/or a fiber optic cable. Preferably, for maintenance purposes, the base member and the cap member are releasably attached to the mounting rod. Other steps in the foregoing method of assembly may be connecting the housing, the base member, and the spring element together with the fastener, and attaching a mirror element to the housing.

Brief Description of the Drawings

The present invention will be more fully understood from the following detailed description, taken in conjunction with the accompanying drawings, wherein like reference numerals refer to like parts, and in which:

5 Figure 1 is a partial perspective view of a mirror mounting assembly according to the present invention in which a mirror housing assembly is disposed on a mounting bar mounted to a vehicle;

10 Figure 2 is a partial perspective view of the rear of the mirror mounting assembly of Fig. 1, which shows a wire routed through the mounting bar into the mirror housing assembly;

 Figure 3 is a partial sectional view of the front of the mirror mounting assembly of Fig. 1, which shows the wire routed through the mounting bar into the mirror housing assembly;

15 Figure 4 is an exploded partial perspective view of the mirror mounting assembly; and

 Figure 5 is a sectional side view of the components of Fig. 4 as assembled.

Detailed Description of the Drawings

20 Detailed reference will now be made to the drawings in which examples embodying the present invention are shown. The drawings and the following detailed description provide a full and detailed written description of the invention and the manner and process of making and using it, so as to enable one skilled in the pertinent art to make and use it. The drawings and detailed description also provide the best mode of carrying

out the invention. However, the examples set forth herein are provided by way of explanation of the invention and are not meant as limitations of the invention. The present invention thus includes modifications and variations of the following examples as come within the scope of the appended claims and their equivalents.

5 As broadly embodied in Figs. 1-5, a mirror mounting apparatus made according to the present invention is provided in which a line or wire is optimally routed through the biaxially adjustable mirror mounting apparatus. As the Figures indicate, the mirror mounting apparatus or assembly 10 includes a mirror housing assembly 44 attached to a mounting rod or bar 12. Rod 12 has a first opening 14, a bore or cavity 16 extending the
10 length of the rod 12, and an outlet or aperture 20 located at a desired point on the rod 12. The line or wire 22 is routed through the rod 12, out the outlet 20, and into the mirror housing assembly 44 to provide, for example, electrical power to mirror adjustment motors M, electronic displays or signals S, or to mirror heating elements H (see Fig. 3).

15 While the Figures generally illustrate the mirror mounting apparatus 10 including a C-shaped rod, such as mounting rod 12, extending substantially normal to a vehicle V, the mirror mounting apparatus 10 can utilize a variety of other installation angles and mounting structures. Likewise, the exemplary mirror housing assembly 44, which is depicted as generally rectangular shaped, mirror housing body 45 and mirror element 11 may possess a variety of geometries and be made of various materials. For example,
20 mirror housing body 45 holding mirror element 11 may be round. Accordingly, it should be understood that the following description of the disclosed aspects of the invention is not intended to limit the present invention to the examples shown in the Figures.

With more particular reference to the Figures, an example of the mirror mounting apparatus 10 is depicted in Fig. 1. Mirror mounting apparatus 10 includes a base member 24 and an optional cap member 28 (shown most clearly in Fig. 4). Base member 24 is securable to the mounting bar 12 via cap member 28 and is configured for attachment to the mirror housing body 45. As suggested, mounting bar 12 may be secured to the vehicle V in any conventional manner and may comprise the C- or U-shaped bar, an extending bar, or any other type of mounting bar.

Fig. 2 shows a similar but larger view of the mirror mounting apparatus 10 of Fig. 1. In this view, wire 22 (illustratively shown as four separate wires) extends into rod 12 from the first opening 14 and along the cavity 16 and a cavity surface 18 of rod 12. The wire 22 eventually exits rod 12 at the outlet 20 and enters into mirror housing assembly 44 where the wire 22 can be connected to a motor or the like (Fig. 3).

Fig. 3 is a partially cutaway front view of the Fig. 2 example. In this illustration, a mirror glass 11 is attached to an optional, possibly plastic, carrier plate P, which is attached to the mirror housing body 45 in a known manner. Of particular note, Fig. 3 shows the various components of the mirror mounting apparatus 10 assembled, whereby a fastener or locking washer 88 releasably locks the components together, described in greater detail below. By way of further example, Fig. 3 shows that a second slide member 64 (see also Fig. 4) may include mounting elements 78, 82 that attach to motors M. The mounting elements 78, 82, may also respectively define an optional first and a second mounting support 80, 84 for added structural integrity.

Fig. 3 also shows that wires 22 may terminate at an optional connector 100. Connector 100, which could be any type of electrical, mechanical, or hydraulic connector, is connected to a plug 102 to supply power to devices M. When devices M, such as control motors, are activated by an external element, such as an adjustment button (not shown) in the vehicle V, the mirror housing assembly 44 may be pivoted, for example, to adjust a reflected image in the mirror element 11.

Alternatively, the present invention contemplates carrier plate P attached to motors M such that only mirror element 11 adjusts relative to stationary mirror housing body 45. It should also be appreciated that the present invention does not require a control motor M. For instance, as Fig. 3 shows, wire 22 can attach to heater element H, or to electronic signal device S embedded in a surface of the mirror element 11, or multiple wires 22 can attach to any combination of the foregoing devices. Moreover, wire 22 may be, for example, a hydraulic or fiber optic line respectively connected to a hydraulic pump or fiber optic device M, or any other wire or line used to control or affect some action in or on mirror housing assembly 44.

Figs. 4 and 5 respectively show exploded and assembled views of the mirror mounting assembly 10. As discussed, the mirror mounting assembly 10 includes the hollow mounting rod 12 through which wire 22 passes. Mirror mounting assembly 10 further includes the base member 24, which attachably seats upon a contour of rod 12 as seen in Fig. 4. Base member 24 may or may not include a conduit or shaft 32, which could be manufactured separately from base member 24. For instance, the conduit 32 could be integrally manufactured with some part of the mirror housing assembly 44 if

desired. In any case, as shown, conduit 32 provides a second opening 34 through which wire 22 exits to a first slide member 54. Likewise, first slide member 54 defines a third opening 56 through which wire 22 continues into the second slide member 64. Second slide member 64 has a sleeve 70 which defines a fourth opening 74 through which wire 22 continues until reaching and passing through a fifth opening 96 of the locking ring 88 and into the mirror housing assembly 44 for attachment to motors M, heating element or the like as suggested.

It should be understood that slide members 54 and 64 may be provided with or without use of motors M. Also, slide members 54 and 64 and motors M could be eliminated in favor of other types of adjustment assemblies, within the scope of the invention. In such cases, wire 22 could be threaded through base member 24 to support signaling or heating functions, rather than positioning functions.

Evident from Figs. 4 and 5, second slide member 64, first slide member 54, and mirror housing body 45 are configured to slide coaxially about the shaft 32 whereupon fastener 88 is fashioned to compress a spring element 86 and releasably hold the foregoing elements together. Moreover, mirror housing body 45, first slide member 54, and second slide member 64 are cooperative to biaxially adjust the mirror housing assembly 44 with mirror glass 11. As suggested, additional or fewer slide members may respectively be added or removed from the present invention depending on the number of axial adjustments desired for the mirror housing assembly 44 or housing body 45, if actuators are adjustably attached to the latter only.

With more particular reference to Fig. 4, mounting bar 12 is received by base member 24 via a channel portion 26. As shown, channel portion 26 optimally defines a curved surface, but channel portion 26 may have other cross-sectional shapes within the scope of the invention. For example, channel portion 26 could have a substantially rectangular or trapezoidal cross-section if desired. The cross-sectional shape of channel portion 26 may be dictated or influenced by the method and material of manufacture of the base member 24 and/or the mounting rod 12.

Further shown in Fig. 4, base member 24 may include the complementary cap member 28, which attaches to the mounting rod 12 substantially opposite the base member 24. Various alternatives may be used to secure cap member 28 to base member 24 and about rod 12, such as nuts and bolts, screws, clips, hinges, collet pins, or the like, designated by the letter B in Fig. 4. Ideally, cap member 28 is removably and adjustably attached to base member 24 to allow for repair, replacement, or adjustment of mirror housing assembly 44 relative to the mounting bar 12. Accordingly, cap member 28 may include screwholes 28 and complimentary screwholes 28b (see Figs. 1, 2 and 4) in the base member 24 for receiving and seating threaded bolts B or one of the foregoing alternatives.

As an alternative to separate base member 24, cap member 28 and connecting elements B, base member 24 may be unitarily constructed with the cap member 28. Accordingly, unitary base member 24 could be slid along mounting bar 12 and attached to the mounting bar 12 in a well known manner.

Fig. 4 further illustrates that the base member 24 includes a first base surface 30 for contacting a second base surface 48 of mirror housing body 45. In this manner, when locking ring 88 is used to compress biasing device 86, first and second base surfaces 30, 48 matingly abut one another. As discussed, base member 24 may in one embodiment integrally include the shaft 32 as shown in Fig. 4. However, shaft 32 can be manufactured separately and subsequently secured to base member 24 if desired. Alternatively, shaft 32 could be formed integrally with some other part of mirror housing assembly 44 and attached to the base member 24.

Shaft 32 preferably defines at least one locking key part such as first and second keys 36, 40. This feature helps preclude unwanted rotation of mirror housing body 45 relative to bar 12, but also assists in locking the components of the mirror mounting assembly 10 together. More specifically, first key 36 defines a first locking surface 38, which interacts with a second locking or transition surface 94 of fastener 88 and is matingly received by a key rest 92 when fastener 88 compresses together the components of the mirror mounting assembly 10. As shown in the embodiment of Fig. 4, keys 36, 40 define a locking groove 42, which has a square cross-section but any shape may be utilized as desired to correspond to a similar shape for key rest 92.

Fig. 5 shows that the compression spring 86 is disposed between washer 88 and a portion of mirror housing assembly 44 when the mirror mounting apparatus 10 is assembled. As shown, locking washer 88 compresses spring 86 into a receptacle 76 of second slide member 64. Locking washer 88 engages the locking groove 42 and may be rotated clockwise or counterclockwise until key 36 aligns with key rest 92 such that

washer 88 holds the assembly 10 together. Thus, mating alignment elements 36, 38, 40, 42, 90, and 92 rotationally secure element 88 relative to assembly 10. Although these elements are shown with planar surfaces and square cross-sections, they may comprise any variety of noncircumferential shapes or surfaces operable to rotatably lock the mirror assembly 10 together. For instance, the shapes of elements 36, 38, 40, 42, 90 and 92, as well as edge 95, could be nonplanar, oblong, oval, or the like and be within the scope of the invention.

In an aspect of the invention, with reference to both Figs. 4 and 5, the mirror mounting assembly 10 includes, as discussed, the mounting rod 12, the base member 24 and conduit 32 with locking key 36, and the mirror housing body 45 for supporting the mirror glass 11, which also defines a passage 50 through which conduit 32 passes. This embodiment may include the first slide member 54 with third opening 56, the first spherical surface 58, the second receiving surface 62, and a first raised arcuate member 60. The second receiving surface 62 defines a second raised arcuate member 61, which defines a first stopping surface 63. When compressibly assembled, the first receiving surface 46 of mirror housing body 45 contacts the first spherical surface 58 of first slide member 54.

This aspect of the invention also includes the second slide member 64 having a fourth opening 74 for passage of the wire 22, a notch 72 located in the vicinity of the fourth opening 74 for passage of locking key 36, a second groove 67 for slideable receipt of the second raised arcuate member 61, one or more mounting elements 78, 82, a second spherical surface 66, and the receptacle 76. The second groove 67 defines a second

stopping surface 68, which in cooperation with the first second stopping surface 63 impedes the movement of the second slide member 64 beyond a predetermined position. Also shown are the optional mounting elements 78, 82 each having a proximal end 78a, 82a and a distal end 78b, 82b. The proximal ends 78a, 82a are attached to the second
 5 slide member 64, and the distal ends 78b, 82b extend away from the proximal ends 78a, 82a and the second slide member 64 for attachment to other devices (not shown) in the mirror mounting assembly 10.

In the foregoing example, mating receiving and spherical surfaces 46, 58, 62, 66 of slide members 54, 64 and mirror housing 44 cooperate to biaxially adjust the mirror
 10 housing assembly 44 relative to base member 24 and mirror mounting bar 12 when an attached motors M, for instance, imparts controlled movement to members 45, 54, and 64. Further detail of electromotive or other interaction of these members need not be given to appreciate or practice the full range of the present invention.

Referring particularly to Fig. 4, fastener 88 of this aspect of the invention may
 15 include an extrusion or projection 98 for contacting and controlling compression element or helical spring 86. When fastener 88 is depressed axially in the direction of the rod 12, projection 98 presses against spring 86 and overcomes the bias of spring 86 to seat the spring 86 into receptacle 76 of second slide member 64. As this compression action occurs, the first key 36 is directed along the notch 72 in the second slide member 64.
 20 Eventually, key 36 passes through a complimentary keyhole 90 of fastener 88 until key 36 is axially level with the second locking surface 94. Upon momentary further depression of fastener 88, first key 36 exits keyhole 90 and simultaneously radially aligns

an inner edge 95 with the locking groove 42 to permit locking ring 88 to be rotated in either direction until the first locking surface 38 of first key 36 is axially and radially aligned with the key rest 92. At this juncture, external axial and torsional pressures to fastener 88 may be released as the first locking surface 38 of first key 36 will releasably rest in key rest 92 and hold the mirror mounting apparatus 10 together as shown in Fig. 5.

With regard to manufacturing possibilities of various elements of the present invention, base member 24 and cap member 28 may be made of a cast metal such as aluminum, although both could be made of a plastic such as nylon, if desired. Slide members 54, 64 may be constructed of a plastic such as nylon. Mirror housing body 45 is optimally made of a plastic such as A.B.S. Regardless of the materials selected, they should allow for secure and reliable attachment together and resist unwanted movement once secured. Additionally, the strength of the compression spring 86 should be strong enough to hold the mirror housing assembly 44 in place. If desired, frictional coatings or surface treatments may be used to alter frictional characteristics to optimize performance.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope and spirit of the invention. For example, the relative position of mating elements such as 52, 60, 61, 67 (grooves and ridges) on opposing parts could be reversed. Also, the cross-sectional shape of bar 12, mating receiving and spherical surfaces 46, 58, 62, 66 of slide members 54, 64, and mirror housing 44 could be altered from that depicted. It is intended that the present invention include such modifications and variations as come within the scope of the appended claims and their equivalents.